R. P. F. III

FINAL REPORT

1. Institute Code No.

Tech X (231)

2. I. C. A. R. Code No.

P1-89/11-ICI-N10/0311

3. Name and Address of Research Institute/Centre:

Central Plantation Crops Research Institute,
Kasaragod, Kerala.

4. Project Title: Design and development of power operated husking machine.

5. Name and Designation of Project Leader: SJD Bosco (Upto May, 1994)
T. Vidhan Singh (June 1994 to May, 1996)

6. Name(s) and Designation(s) of Project Associates including Project Leader and work to be done:

Sl. No.	Name and Designation	Time spent	Work done
1.	S.J.D. Bosco Scientist (Agril. Struct. & Proces Engg.)		Design, development, Fabrication & testing of proto type.
2.	T. Vidhan Singh Scientist (Farm Machinery & Power)		Design, development, fabrication & testing of working model.

7. Location of Research Project with complete address (Division/Section/Sub-Centre)

Pre & Post Harvest Technology Division
CPCRI, Kasaragod, Kerala 671 124.

8. Date of start: May, 1989

9. Date of termination: May, 1986

10. (a) Objectives (Not more than 150 words)

To develop a power operated coconut husking machine to dehusk 500-600 coconuts per hour.

(b) Practical Utility including background information (Not more than 150 words)

Irrespective of the end product, whether copra or dessicated coconut, the first stage in coconut processing is removal of the husk. Practically in all coconut producing areas the husk is removed by hand, by piercing the coconut on a sharp iron or wooden spine fixed in the ground. For this skilled person is required. Many attempts to mechanise the husking operation failed to produce any working model. For large scale dehusking this machine will be very useful.

CENTRAL PLANTATION CROPS RESEARCH INSTITUTE
KASARAGOD-670 124, KERALA

R P F III

Project No.

Date of Start: 1989

11. Technical Programme

1. To study the defects in the existing CPCRI manually operated coconut dehusker.

2. Design and development of power operated coconut dehusker.

Observations to be taken

The time motion study for husking one coconut will be conducted.

Technical programme - 1989-90 (SJD Bosco)

1. To study the defects in the CPCRI leg operated dehusker.
2. Design of the dehusker
3. Fabrication of the dehusker
4. Testing of the fabricated parts.

Technical programme - 1990-91 (SJD Bosco)

1. Fabrication of the machine
2. Testing of all the parts
3. Perfection, if needed.

Tech. Programme for 1991-92

1. Fabrication of the modified splitting parts.
2. Testing and assembling.

Technical Programme for 1992-93 & 93-94

1. Providing spring system
2. Assembling and testing.
3. Fabrication of proto-type.

Technical Programme for 1994-95

1. Providing suitable gear boxes
2. Providing suitable other accessories in connection with power transmission system
3. Assembling and testing.

P.T.O.

Technical Programme for 1995-96

1. Assembling gear boxes shafts etc.
2. Testing & Trial runs
3. Modifications if necessary
4. Final testing and evaluation of efficiency.

CENTRAL PLANTATION CROPS RESEARCH INSTITUTE

KASARAGOD-670 124, KERALA

R P F III

Project No. Tech X (231)

12. Final Report: 1989 —1996 Date of Start: May, 1989

Design and development of power operated coconut husking machine.

The dehusking operation of the coconut in the conventional system (using iron bar) and in three models of the manually operated machine was studied. Finally it was decided that the third model is more suitable for developing the power operated one. The time motion study of this manually operated coconut dehusker was conducted and the following results were obtained.

The force required to operate the foot leaver and hand leaver were measured as 110 kg and 40 kg respectively. By considering these forces, the various members of the device were designed. The expected time required for dehusking one coconut in this device is as follows:

S.No.	Motion (activities)	Time in seconds
1.	Picking the nut and positioning on the splitting blades	5.91
2.	Piercing (pressing the foot leaver)	2.70
3.	Scooping (Hand leaver operation)	3.05
4.	Lowering the foot leaver and removing the nut from the blade and then husk from the nut	9.13
5.	Cleaning the platform	2.00
	Total	23.09

(2)

(i) Six fixed blade sets are fixed on a rotating plateform. This plateform will rotate once in 6 seconds to an angle of 60° in such a way that each time once fixed blade will come under the splitting blade. Then after completing dehusking operation, this disc will rotate and then the next fixed blade will come to the position. Therefore the positioning of the nut in the blade does not required any time.

(ii) When the fixed blade with nut comes under the splitting blade, the splitting blade will come down and pierce the nut. For this the expected time required is 1.00 seconds.

(iii) At the end of the piercing operation, the leaver for splitting the blade will be operated. This requires 2.00 seconds.

(iv) After splitting, the splitting blade will come up leaving the husked coconut on the fixing blade. This requires 1.00 second.

(v) Then the fixed blade with husked nut will come away and the next blade set with unhusked coconut will come to the position.

Thus it will take 4 seconds to dehusk one coconut. By allowing 1 second as allowance, totally 5 seconds will put of this device as 600 to 700 nuts/hour. The man power required to operate this device will be one unskilled man and woman.

Conclusion

The working condition of the existing three manuall operated coconut dehusking machine was studied. The third and final model was selected for the modification of the same into power operated one. For this the force required for each activity and the force to be withstand by each member of the device were calculated. Then the final design of the device has been completed. Fabrication of the six fixed blade sets with the rotating arrangement was completed. Other fabrication work is under progress.

Design and Development of Power Operated Coconut Husking Machine

T. Vidhan Singh

Materials and Methods

Working principle

The power obtained from the electric motor through reduction gear is utilized for three different operations viz., piercing, splitting-cum-peeling and positioning the coconut. The vertical reciprocating motion for piercing into the coconut husk by the set of blades is obtained by providing crank in the main shaft. The horizontal reciprocating motion for splitting and peeling the husk is obtained by providing a vertical crank shaft which will perform its operation immediately after the piercing operation. Another vertically rotating shaft is attached to the set of six fixed blades to hold the coconut which is powered from the main shaft through a cam disc so as to rotate this vertical shaft to 60° for every one full rotation of the main shaft.

Description

The detailed parts of the dehusker with broad dimensions and specifications are shown in Fig.1-5. The power source for the dehusker is 2.25 kW, 3∅, 1425 rpm electric motor (Fig.1, part No.1). A reduction gear box (Fig.1, part No.2) is connected to the motor to get the output of 10 rpm. A shaft with a crank (Fig.1, Part No.3) is connected to a gear box (Fig.4, part No.4) of single input and double output, from where power is taken for scooping and positioning operation. The crank of the main shaft is connected to vertically reciprocating shaft (Fig.1, part No.5) of the scooping blade set unit by means of connecting levers and a shock absorber (Fig.1, part No.8). The scooping blade set consists of two circular mild steel discs. The bottom disc (Fig.1, part No.9) is welded to the vertically reciprocating shaft (Fig.1, part No.5). At the base of this bottom disc, three blades are fixed and a set of another three blades hinged to these fixed blades. The top rotating disc (Fig.1, part No.10) with guide slot is fitted in alignment and just

above the bottom disc (Fig.1, part No.9).The scooping blades move out radially when the rotating disc is pushed by a handle(Fig.3, part No.11) fixed on it. A vertical crank shaft (Fig.2, part No.12) connected to a gear box of ratio 1:2, horizontal input : vertical output (Fig.2, part No.13), is provided which will push the handle (Fig.3, part No.11) twice for every one rotation of the main shaft. This gear box is flanged with one of the output shaft of the gear box (Fig.4, part No.4). The other end of the vertical crank shaft (Fig.2, part No.12) is fixed to the main frame (Fig.1, part No.14) by means of ball bearing. The other output shaft of the gear box (Fig.4, part No.4) is connected to a cam disc (Fig.4, part No.15). This cam disc rotates the vertical shaft (Fig. 1, part No.16) of the coconut positioning unit (Fig.1, part No.17) to 60° for every one rotation of the main shaft. The coconut positioning unit consists of six circular discs (Fig.3, part No.18) connected to the vertical shaft (Fig.1, part No.16) by means

of connecting rods. On each circular disc (Fig 1,part No 17) there are three fixed blades positioned at an angle of 120° projecting up and in vertical alignment with the top scooping blades. The shock absorber (Fig.1, part No.8) mainly consists of a compression spring and spring housing, the sectional details of which is given in the Fig.5. The starter is positioned on the main frame, very near to the labourer operating the dehusker so as to enable him to stop the machine easily if required (Fig.2, part No.19). The entire machine is installed on a wooden platform for reducing vibration (Fig.1, part No.20). The details of parts of the machine is enlisted in Table-1.

Table-1:- **Details of part numbers shown in figures 1,2,3,4 & 5**

Part No:	Description
1	Electric motor.
2	Reduction gear : Horizontal input and output.
3	Main shaft with crank.
4	Gear box :Single input and double out put.
5	Vertical reciprocating shaft of the scooping blades set unit.
6	Scooping blade set unit.
7	Connecting lever.
8	Shock absorber unit.
9	Bottom disc.
10	Top rotating disc.
11	Handle of the rotating disc
12	Vertical crank shaft.
13	Gear box of 1:2 ratio, horizontal input : vertical output.
14	Main frame.
15	Cam disc
16	Vertical shaft of the coconut positioning unit.
17	Coconut positioning unit.
18	Circular disc for fixed blade.
19	Starter
20	Wooden platform

Operation of the dehusker

First, switch on the electric motor and check the sequence and timings of the operation. After verification. coconuts are kept on the fixed blades (Fig.3, part No.18), one by one. Coconut should be placed in between the fixed blades vertically facing its stalk end upwards. As the fixed blade with coconut reaches just below the scooping blade set unit, the blades will pierce into the coconut husk. At the end of piercing operation, the scooping blades will open and scoop the husk into three lobes. At the end of scooping operation, the blade will move up and simultaneously the coconut positioning unit gets power to position the next coconut holding fixed blade for dehusking operation. Labourer who keeps the coconut on to the fixed blade also removes the dehusked coconut from the fixed blade. The loosened husk is removed easily from the nut by hand by another labourer.

Results and Discussion

The machine was tested during the years 1993,1994,1995,and1996 and all the minor defects encountered were rectified.The machine was tested for about 25 times using different varieties and different sizes of nuts for its performance. The time required for dehusking one coconut is about 6 seconds. Two labourers are required to do all the operations in sequence. Though the theoretical output of the machine is 600 nuts/hour, it was possible to dehusk about 500 nuts/hour only. This is because, in some dehusked coconuts, one of the scooped lobes does not get detached from the nut. Thus, the output of the machine varied from 500-600 nuts/hour. Since the size of nuts and thickness of husk varies considerably,this minor problem would always exist. The blades which are made of spring steel does not require resharpening and replacement. The life of the machine is expected to be about 10 years. The major constraint was that of positioning the nut exactly below the splitting mechanism which was overcome by using a locking mechanism. The spring loaded mechanism used in the shock absorber ensures absorption of excess load, once the blades touches the shell, there by avoiding breakage of nuts. The breakage was below 2%.

Economics of the Dehusker

Basic details:

1.Expected life	10 years
2.Use of the dehusker in an year	300 days
3.Approximate time required to dehusk one nut	6 seconds
4.Labour requirement for operation of the dehusker including peeling	2 per 8 hours

Fixed cost:

1.Cost of motor and starter	Rs 5500.00
2.Cost of reduction gears	Rs 22,000.00
3.Cost of bearing and couplings	Rs 2000.00
4.Cost of angle iron materials, disc etc	Rs 4500.00
Total fixed cost	Rs 34,000.00

Recurring cost:

1.Interest on fixed cost	Rs 3400.00
2.Depreciation	Rs 3400.00
3.Cost of two labors @ 80.00 per day for 300 days	Rs 48,000.00
4.Cost of electricity @24 units per day for 300 days	Rs 7200.00
5.Annual maintenance cost	Rs 1500.00
Total recurring cost	Rs 63,500.00

Number of nuts dehusked in one day is 4000.

Total number of nuts dehusked in one year is 12,00,000.

Therefore, cost of dehusking is Rs 0.05/nut.

Economic viability of the device:

The device costs about Rs 34,000.00 including the cost of motor, gears, etc. The life of the device is assumed to be 10 years. The out turn of the device is taken as 500 nuts/hour. The machine is assumed to operate for 2400 hours/year. Two labourers are required. Thus, the cost of dehusking one coconut works out to Rs 0.05 / nut. By assuming the out turn in the traditional method of dehusking as 125 to 250 nuts/hour, and the skilled labourer cost as Rs 15.00 per hour, the cost of dehusking is Rs 0.06 to Rs 0.12 per nut. Thus, even at maximum out turn in traditional method, the cost of dehusking is more than double that of this machine and that too with more fatigue. Hence, the benefits accrue to both operators and farmers.

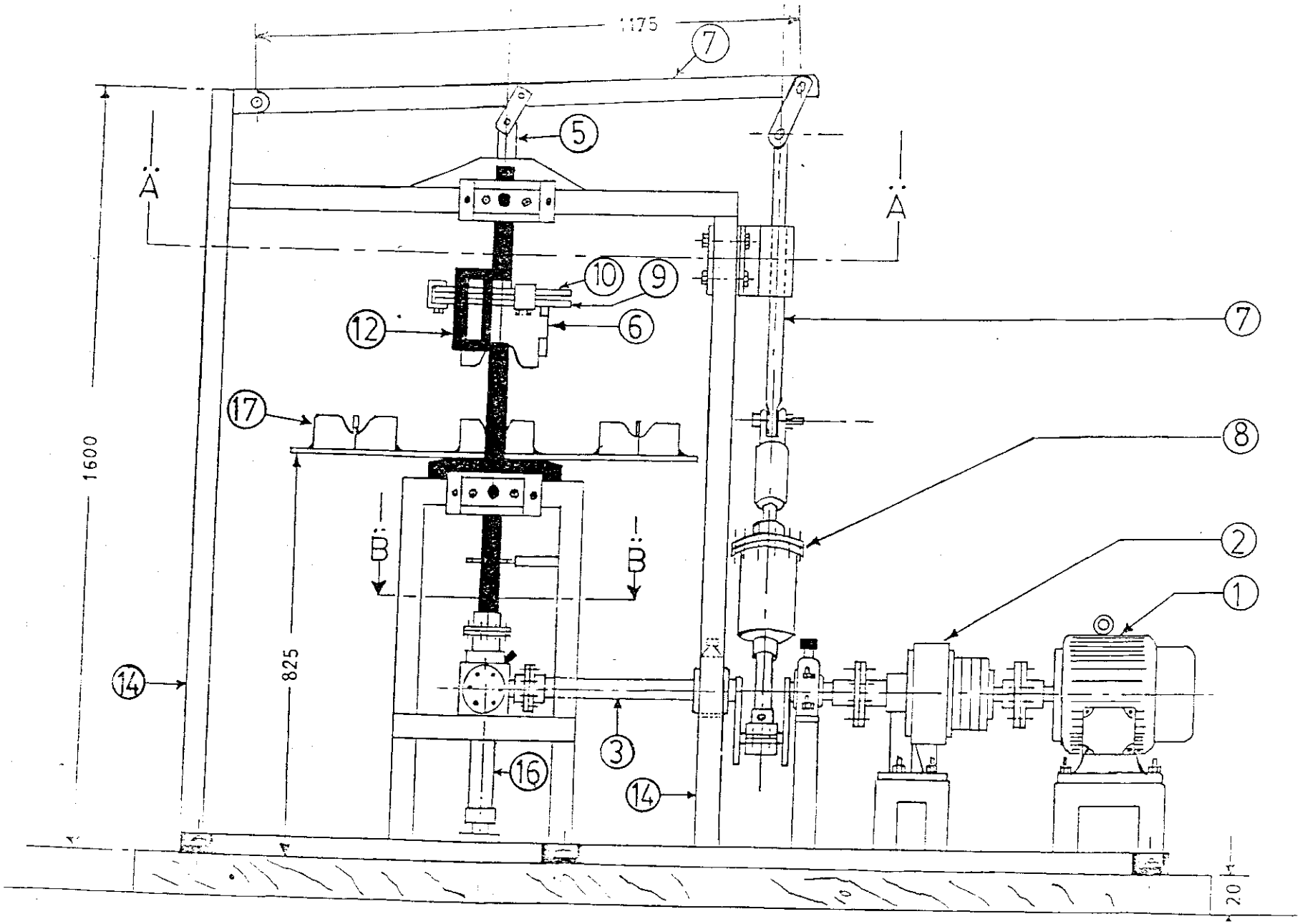

Fig.1. Front view of Coconut Husking Machine

(Scale 1:10. All dimensions in mm)

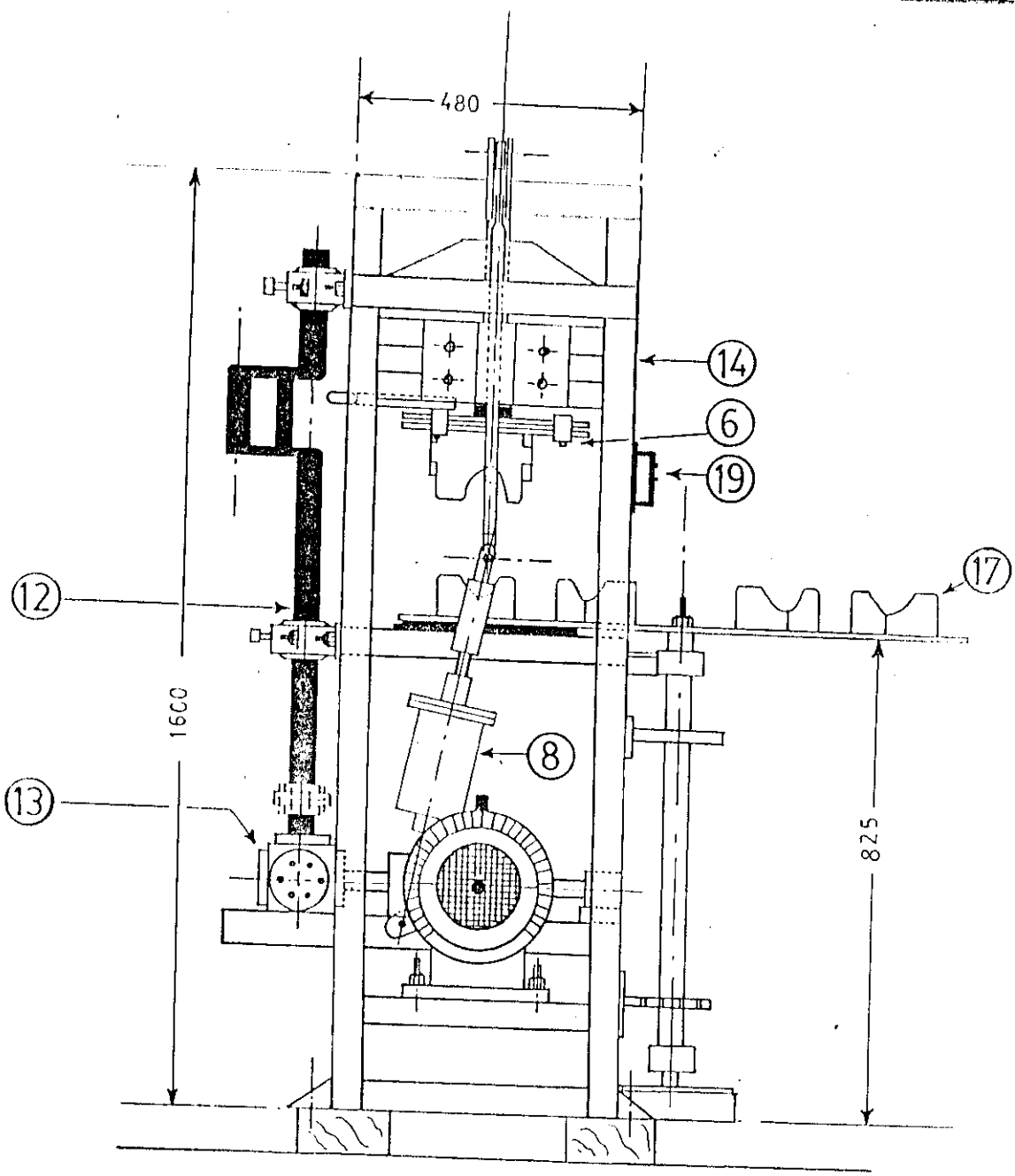

Fig.2. Side view of Coconut Husking Machine

(Scale 1:10, All dimensions in mm)

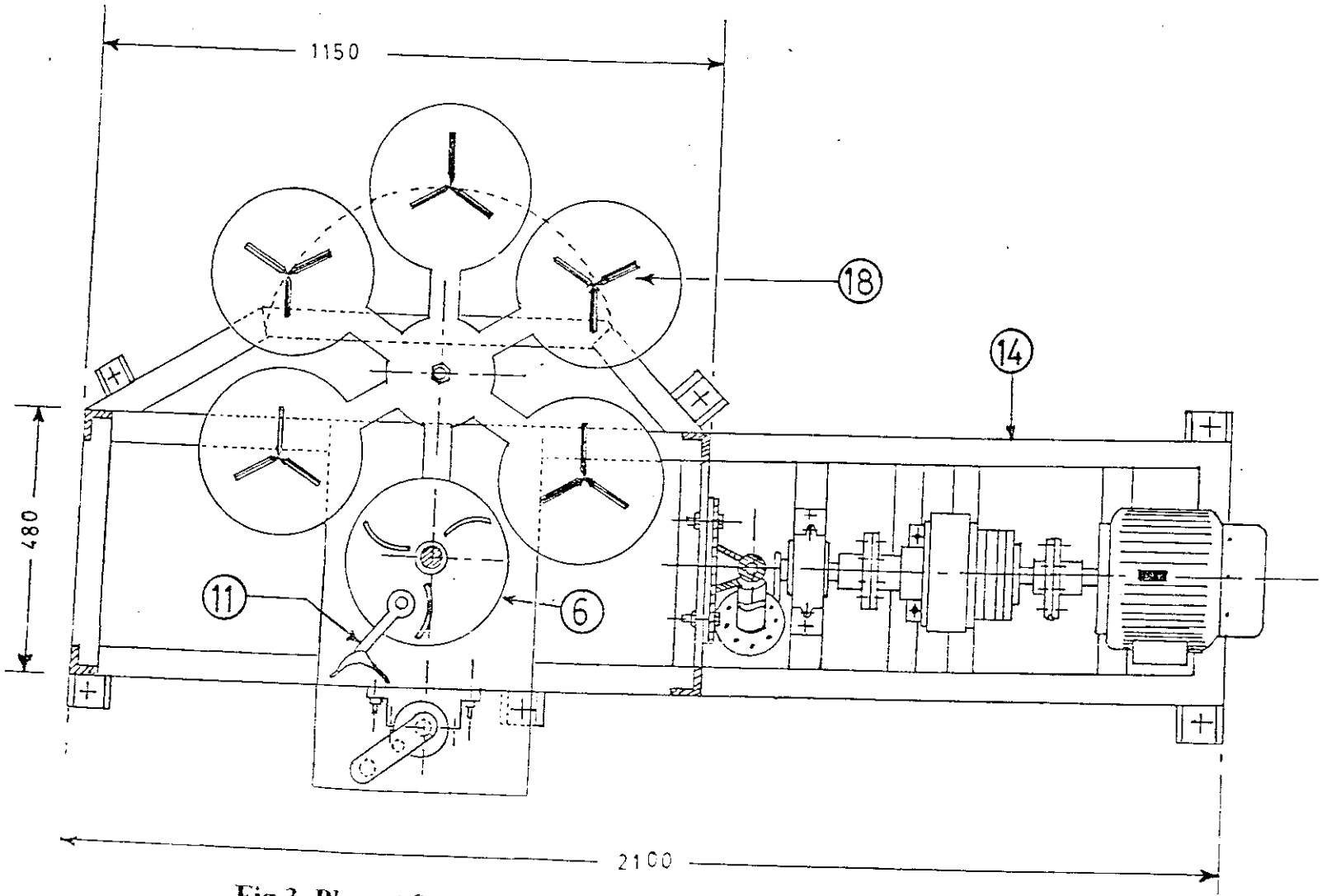

Fig.3. Plan at Section A-A in the Front View

(Scale 1:10, All dimensions in mm)

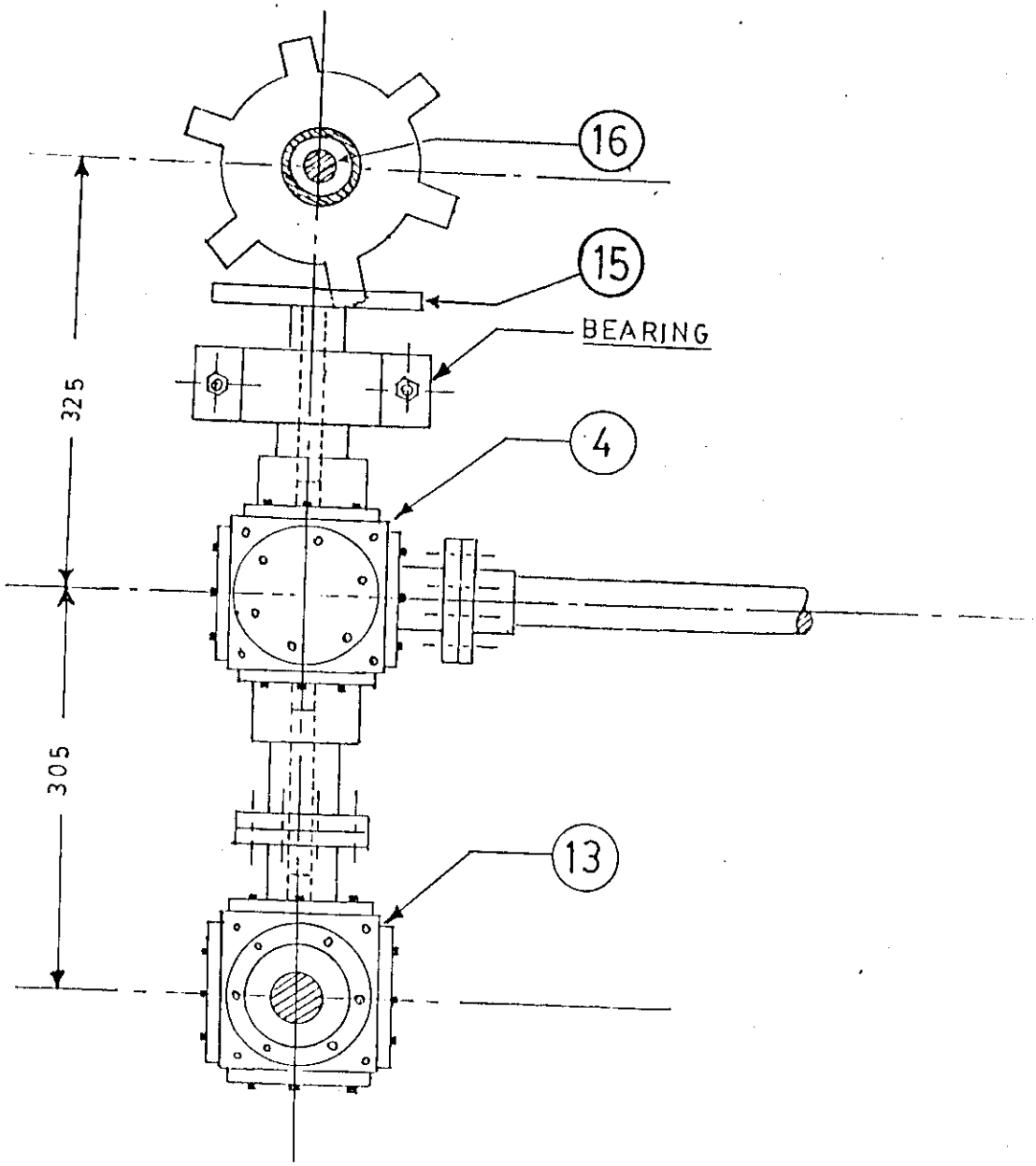

Fig.4.Plan at Section B-B in the Front View

(Scale 1:5, All dimensions in mm)

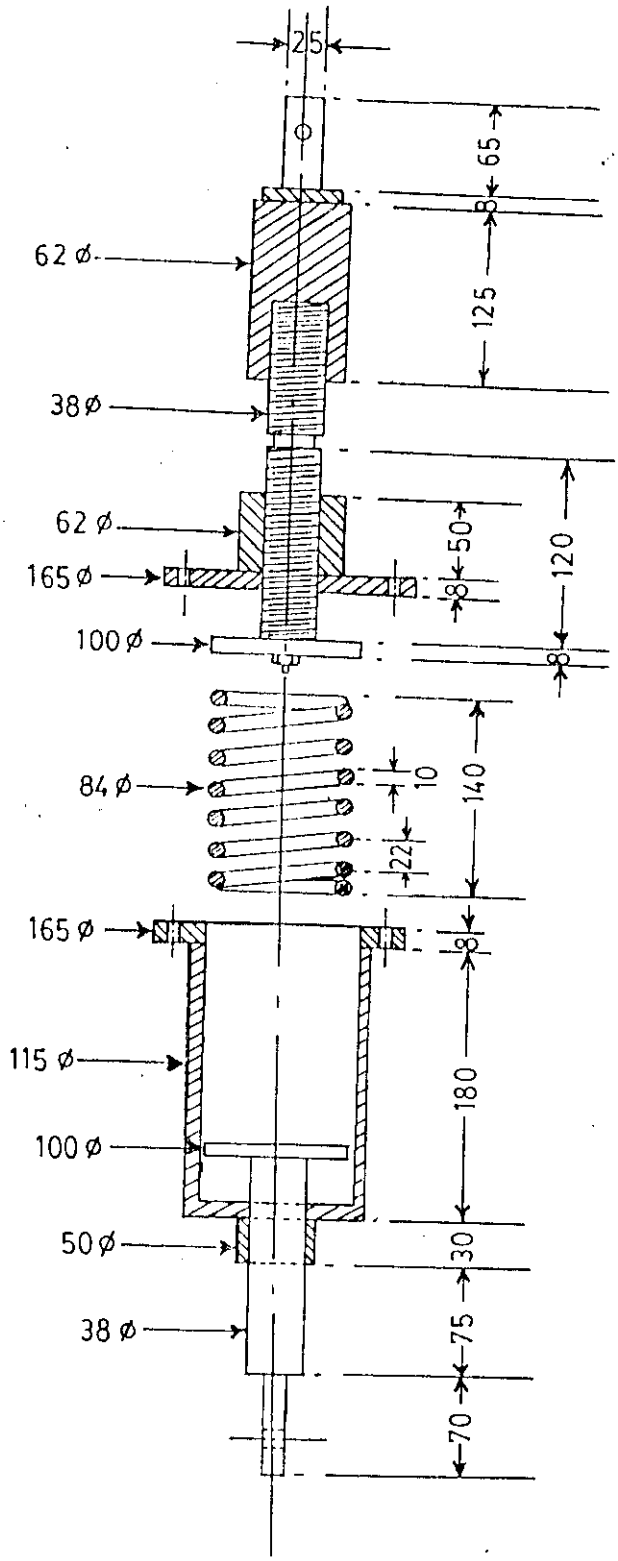

Fig.5.Sectional view of item No:8

(Scale 1:5, All dimensions in mm)

13. Approximate expenditure incurred in the Project: (Give reasons for variation, if any, from original estimated cost)

Rs. 1,75,000/-

The project could not be completed in the stipulated time due to various reasons as mentioned in Annual Progress Reports.

14. Publications and material (one copy each to be supplied with this proforma)

a) Research papers — Under print

b) Popular articles — Nil

c) Reports — In CPCRI Annual Report, 1991, - 1996

d) Seminars and workshops (Relevant to the Project) in which the Scientists have participated:

Attended Annual Workshop of AICRP on P & PHT

e) Material developed (such as new varieties of crops or breeds of farm animals, implements, products, etc.)

Power operated coconut husking machine to dehusk about 500 nuts/hr.

15. Details (Nos. etc.) of Field/Laboratory Note books and final material and their location

In primary project file, Pre & Post Harvest Technology Division, CPCRI, Kasaragod - 671 124.

16. Comments/suggestions of Project Leader regarding possible future line of work that may be taken up arising of this project:

Automatic feeding can be incorporated which will reduce the labour requirement from two to one thereby reducing the cost of dehusking

17. Signatures with name of Project Leader and Associates:

9/5/97

(T. Vidhan Singh)
Project Leader

18. Signature (with comments, if any) of Head of Division/Section/Station:

Madhavan K

(K. Madhavan)

19. Signature (with comments, if any) of Director:

(Dr. M.K. Nair)